

Claims

1. An inner riser adjustable hanger and seal assembly for applying tension to a casing string secured at a lower end within a well and supported at an upper end by a wellhead housing, the hanger and seal assembly comprising:
 - 5 a wellhead housing having a housing locking member on an inner surface thereof;
 - a tensioning mechanism for tensioning the casing string and securing the upper end of the tensioned casing string to the wellhead housing;
 - a seal body for positioning within the wellhead housing;
 - 10 a seal body locking member radially movable into engagement with the housing locking member to fix the axial position of the seal body relative to the wellhead housing;
 - an upper seal assembly for sealing between the seal body and the wellhead housing; and
- 15 a lower seal assembly for sealing between the seal body and the casing string, such that the casing string is tensioned without appreciable rotation of the hanger body.
2. An inner riser adjustable hanger and seal assembly as defined in Claim 1, wherein the casing string is tensioned without appreciable rotation of the upper and lower seal assemblies.
- 20 3. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

at least one of an outer surface of the upper end of the casing string and an inner surface of the seal body is tapered; and

a setting sleeve moves axially relative to the seal body to move the lower seal assembly into sealing engagement with both the seal body and the upper end
5 of the casing string.

4. An inner riser adjustable hanger and seal assembly as defined in
Claim 3, further comprising:

at least one shear member for interconnecting the setting sleeve and the seal body; and

10 a detent ring radially movable to allow shearing of the shear member to set the lower seal assembly.

5. An inner riser adjustable hanger and seal assembly as defined in
Claim 4, further comprising:

15 a plurality of circumferentially spaced buttons for moving the detent ring radially inward.

6. An inner riser adjustable hanger and seal assembly as defined in
Claim 3, further comprising:

a radial collapsible detent ring; and
one or more shear pins for interconnecting the setting sleeve and the seal
20 body, such that an axial force is transmitted to shear the shear pins to move the detent ring radially inward.

7. An inner riser adjustable hanger and seal assembly as defined in
Claim 4, further comprising:

a plurality of radially moveable buttons for moving the detent ring into a collapsed position prior to shearing the shear pins.

8. An inner riser adjustable hanger and seal assembly as defined in Claim 1, wherein the seal body locking member is a C-ring.

5 9. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

a support ring, at least a portion of which is positionable radially inward from and axially moveable relative to the seal body locking member for maintaining the engagement member in engagement with the housing locking member.

10 10. An inner riser adjustable hanger and seal assembly as defined in Claim 8, wherein the C-ring is carried on the seal body and is biased radially outward.

11. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

15 a centralizing ring positioned at a lower end of the seal body for centralizing the lower end of the seal body relative to the upper end of the casing string.

12. An inner riser adjustable hanger and seal assembly as defined in Claim 1, further comprising:

at least one of an outer surface on the seal body and an inner surface on the
20 wellhead housing is tapered; and

the upper seal assembly moves axially relative to the wellhead housing from a run-in position to a set position to seal between the seal body and the wellhead housing.

13. An inner riser adjustable hanger and seal assembly for applying tension to a casing string secured at a lower end within a well and supported at an upper end by a wellhead housing, the hanger and seal assembly comprising:

a wellhead housing having a plurality of axially spaced grooves on an inner 5 surface thereof;

a tensioning mechanism for tensioning the casing string and securing the upper end of the tensioned casing string to the wellhead housing;

a seal body for positioning within the wellhead housing;

10 a plurality of teeth radially movable into engagement with the plurality of axially spaced grooves to fix the axial position of the seal body relative to the wellhead housing;

an upper seal assembly for sealing between the seal body and the wellhead housing; and

15 a lower seal assembly for sealing between the seal body and the casing string, such that the casing string is tensioned without appreciable rotation of the hanger body, the upper seal assembly, or the lower seal assembly.

14. A method of applying tension to a casing string secured at a lower end within a well and supported at an upper end by a wellhead housing, the method 20 comprising:

providing a wellhead housing having a housing locking member on an inner surface thereof;

providing a tensioning mechanism for tensioning the casing string;

- securing the upper end of the casing string to the wellhead housing;
- positioning a seal body within the wellhead housing;
- providing a seal body locking member;
- radially moving the seal body locking member into engagement with the
- 5 housing locking member to fix the axial position of the seal body relative to the wellhead housing;
- positioning an upper seal assembly between the seal body and the wellhead housing, for sealing therebetween; and
- positioning a lower seal assembly between the seal body and the casing
- 10 string, such that the casing string is tensioned without appreciable rotation of the hanger body.

15. A method as defined in Claim 14, further comprising:

tensioning the casing string without appreciable rotation of the upper or lower seal assemblies..

15 16. A method as defined in Claim 14, further comprising:

providing at least one of a tapered outer surface of the upper end of the casing string and a tapered inner surface of the seal body;

providing a setting sleeve axially movable relative to the seal body; and

axially moving the setting sleeve relative to the seal body to move the lower

20 seal assembly into sealing engagement with both the seal body and the upper end of the casing string.

17. A method as defined in Claim 14, further comprising:

providing at least one shear member;

providing at least one detent ring;
interconnecting the setting sleeve and the seal body with the shear member;
and
selectively radially moving the detent ring to allow shearing of the shear
5 member to set the lower seal assembly.

18. A method as defined in Claim 14, further comprising:
providing a support ring;
positioning at least a portion of the support ring radially inward from the seal
10 body locking member; and
axially moving the support ring relative to the seal body locking member to
maintain the seal body locking member in engagement with the housing locking
member.
19. A method as defined in Claim 14, further comprising:
15 providing a centralizing ring;
positioning the centralizing ring at a lower end of the seal body for
centralizing the lower end of the seal body relative to the upper end of the casing
string.